ARGUMENTS/REMARKS

Applicants would like to thank the Examiner for the careful consideration given the present application. The application has been carefully reviewed in light of the Office action, and amended as necessary to more clearly and particularly describe and claim the subject matter which applicants regard as the invention.

A new Abstract has been provided, as required by the Examiner. Amended Figure 38 has been labeled "PRIOR ART" as suggested by the Examiner.

An accurate translation of the certified copy of the priority document already filed in this case is included herewith to perfect the priority claim as discussed below.

Claims 1-14 remain in this application. New claims 15-20 add additional features from the specification without adding any new matter.

Claims 2-6, 8-11, and 14 were rejected under 35 U.S.C. §112, second paragraph, for being indefinite. The rejected claims have been amended, making the rejections moot.

Claims 1, 9, 10, 12, and 13 were rejected as being anticipated by Yanagihara *et al.* (U.S. 5,745,644). Claims 2-5, 8 and 11 were rejected under 35 U.S.C. §103(a) as being unpatentable over Yanagihara in view of Furukawa *et al.* (U.S. 2001/0017887 A1). Claims 6, 7, and 14 were rejected under 35 U.S.C. §103(a) as being unpatentable over Yanagihara in view of Shimizu *et al.* (U.S. 5,748,245). For the following reasons, the rejections are respectfully traversed.

Claim 1, as amended, recites "rate correction data producing means" for producing "rate correction data to be added to said compressed moving picture data" wherein the rate correction data "is used by another apparatus to change the bit rate of said compressed moving picture data". Claim 9, as amended, recites similar limitations at lines 7-12. New claim 15 recites similar "rate correction data" and bit rate changing limitations at lines 5-8. Claim 12, as amended, claims the "another" apparatus that uses the rate correction data to change the bit rate of the moving picture data. The cited references do not teach these limitations of claims 1, 9, 12, and 15.

The Examiner cites Yanagihara as teaching a moving picture coding apparatus

according to claims 1, 9, and 12. However, Yanagihara does not teach the production of any "rate correction data" which is used by *another* apparatus to change the bit rate of already compressed moving picture data. Nowhere does Yanagihara even discuss *another* apparatus changing a *bit rate*. Thus, claim 1 is patentable over Yanagihara. Neither Furukawa nor Shimizu overcome the shortcomings of Yanagihara (neither suggest the claims "another" apparatus), and thus the claims are also patentable over the combination of references as well.

Claims 2-8, which depend, directly or indirectly, on claim 1, claims 10-11, which depend on claim 9, claims 13-14, which depend on claim 12, and new claims 16-20, which depend, directly or indirectly, on claim 15, are thus also patentable over the reference for at least the same reasons as their parent claim.

In addition, the Furukawa reference is not properly cited prior art under 35 U.S.C. §102. Section 102(b) states that a reference is prior art if it is "a printed publication in this or a foreign country [published] more than one year prior to the date of the application for patent in the United States". Further, §102(e)(1) states that a reference is prior art if it is "an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent". The current application was filed on July 5, 2001. The publication date of the Furukawa reference is August 30, 2001. Thus, it is not prior art under §102(b). Furthermore, the priority document of this application was filed on July 7, 2000 (the priority document has already been submitted in this case, and an accurate translation of the priority document is included herewith), whereas the filing date of the Furukawa reference is January 26, 2001, and thus the priority document for the invention was filed first. Hence, Furukawa is not a proper prior art reference, and the examiner is requested to withdraw the rejections based on that reference.

Furthermore, the Examiner has not provided the proper motivation for combining the references. The burden is on the Examiner to make a prima facie case of obviousness (MPEP §2142). To support a prima facie case of obviousness, the Examiner must show that there is some *suggestion* or *motivation* to modify the reference (MPEP §2143.01). The mere fact that references *can* be combined or modified, alone, is not sufficient to establish prima facie obviousness (*Id.*). The prior art must also suggest the *desirability* of the combination (*Id.*). The fact that the claimed invention is within the *capabilities* of one of ordinary skill in the art is not sufficient, by itself, to establish prima facie obviousness (*Id.*).

The Examiner has cited no support for any such suggestion or motivation for the combination from within the references, and neither does the Examiner provide any references supporting any motivation to modify the reference(s) by making the combination.

Merely listing an advantage or benefit of the combination is not sufficient, as some rationale for combining the references must be found in the references themselves, or drawn from a convincing line of reasoning based on established scientific principles practiced by one skilled in the art that some advantage or beneficial result would be produced by the combination (MPEP §2144). Such motivation cannot be found in the application itself, as such hindsight is impermissible; the facts must be gleaned from the prior art. (MPEP §2142, last paragraph).

"To reach a proper determination under 35 U.S.C. 103, the examiner must step backward in time and into the shoes worn by the hypothetical 'person of ordinary skill in the art' when the invention was unknown and just before it was made [and] the examiner must then make a determination whether the claimed invention '*as a whole*' would have been obvious at that time to that person." (MPEP §2142, emphasis added). It is not proper to merely combine various elements from various references. The invention must be obvious "as a whole", not as a piecemeal combination of elements from various references.

Accordingly, the rejections for obviousness are not supported by the Office action and thus the rejections are improper, and should be withdrawn.

In consideration of the foregoing analysis, it is respectfully submitted that the present application is in a condition for allowance and notice to that effect is hereby requested. If it is determined that the application is not in a condition for allowance, the examiner is invited to initiate a telephone interview with the undersigned attorney to expedite prosecution of the present application.

If there are any additional fees resulting from this communication, please charge same to our Deposit Account No. 16-0820, our Order No. 33872.

Respectfully submitted,

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May 24, 2004

ABSTRACT

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An apparatus for compressing an uncompressed motion picture to generate compressed motion picture data, and also for generating and including rate correction data to be used by another apparatus to change the bit rate of the compressed motion picture data without decoding all of the encoded packets in the compressed motion picture data.

[Designation of Document] Specification

[Title of the Invention] Moving image coding apparatus

[Claims]

[Claim 1]

A moving image data producing apparatus which is characterized in that: the non-compression moving image data is an input, and the apparatus is provided with a quantization means and a rate correction data producing means for producing the rate correction data which is the data used at the time of bit rate change, and the moving image data having the rate correction data other than normal moving image stream is produced.

[Claim 2]

A moving image data producing apparatus according to Claim 1, wherein the rate correction data producing means conducts the quantization different from the quantization means on an area in which the bit generation amount in each frame of the moving image data is large, and the rate correction data in which the rate change is possible, is produced.

[Claim 3]

A moving image data producing apparatus according to Claim 1, wherein the reate correction data producing means, in a P frame of the moving image data, conducts the quantization different from the quantization means on an area in which the provability referred at the time of the movement forecast time is low, and the rate correction data in which the rate change is possible, is produced.

[Claim 4]

A moving image data producing apparatus according to any one of Claims 1 to 3, wherein the apparatus has a means for recording the reference inhibition area information which shows an area having the rate correction data in each frame of the moving image data, and when it conducts the movement forecast in the next frame, the reference to the area which the reference inhibition area information shows, is inhibited, and the apparatus has a movement compensation means for conducting the movement compensation.

[Claim 5]

A moving image data producing apparatus according to Claim 1, wherein the apparatus has a movement compensation means for outputting the referenced area information referred to at the time of the movement forecast, and the rate correction data producing means uses the referenced area information and selects the area in which the referenced degree is low in the frame, and the rate correction data in which the rate change is possible to the selected area, is produced.

[Claim 6]

A moving image data producing apparatus according to Claim 1, wherein the rate correction data producing means deletes the high frequency components to an original image and conducts the same quantization as the quantization means, and produces the rate correction data in which the rate change is possible.

[Claim 7]

A moving image data producing apparatus according to Claim 1, wherein the rate correction data producing means decides a position at which the rear portion bits can be deleted, to the area structured by a continuous arbitrary number of macro-blocks (for example, 16 x 16 pixels), and produces the rate correction data in which the position information in which the rate change is possible, is recorded.

[Claim 8]

A moving image data producing apparatus according to Claim 1, wherein the rate correction data producing means produces an I frame which is a coding image inside the frame, and produces the rate correction data in which the rate change is possible.

[Claim 9]

A moving image data producing apparatus which is characterized in that the non-compression image data is an input, and the apparatus comprises: the quantization means; the rate correction data producing means for producing the rate correction data which is the data used when the bit rate is changed; and a means for deciding a quarry out area in which an area as an area of a portion of the frame is quarried out and coding is made possible, and the apparatus produces the moving image data having together the rate correction data other than the normal moving image stream.

[Claim 10]

A moving image data producing apparatus according to Claim 9, wherein the rate correction data producing means produces the rate correction data in which the rate change is possible, to areas at least more than 1 in respective quarry out areas in each frame.

[Claim 11]

A moving image data producing apparatus according to Claim 9, wherein the apparatus has a movement compensation means characterized in that the reference to the area having the rate correction data in the preceding frame and to the different quarry out area, is inhibited, and the movement forecast is conducted.

[Claim 12]

A moving image coding apparatus in which the moving image data which is previously compression coded, is an input, and which has the bit rate correction means by which the bit rate is changed by referring to the rate correction data, and in which the moving image

data whose bit rate is different, is newly produced and outputted, and the moving image coding apparatus which is characterized in that the previously coded moving image data is not decoded, and the bit rate is changed.

[Claim 13]

A moving image coding apparatus according to Claim 12, wherein the bit rate correction means uses the rate correction data whose bit amount is different, included in the inputted moving image data, and by replacing the previously coded moving image data, corresponding to the objective bit rate, the bit rate change is conducted.

[Claim 14]

A moving image coding apparatus according to Claim 12, wherein the bit rate correction means selects an area in which the bit can be deleted, shown in the rate correction data included in the input moving image data corresponding to the objective bit rate, and by deleting the bit, the bit rate change is conducted.

[Detailed Description of the Invention]

[0001]

[Technical Field to which the Invention Belongs]

The present invention relates to a bit rate control method in a moving image coding apparatus to produce the moving image data in which the bit rate is different, from the compression coded moving image data.

[0002]

[Related art]

Recently, according to the development of the digital signal processing engineering, the moving image data can be compression coded, and the compression coded moving image data is easily treated. Further, with the development of a computer network, the chance to transmit and receive the compression coded moving image data through various transmission paths is increased. For example, as a TV broadcasting station, a large amount of the moving image data previously accumulated, is compression coded and saved, and as a VOD (Video On Demand), at the need of the user, the compression coded moving image data can be transmitted onto the transmission path.

[0003]

However, in the case where the compression coded moving image data is transmitted onto the transmission path, there is sometimes a case where the bit rate which can be transmitted on the transmission path is different from the bit rate of the moving image, and in the case where the bit rate of the moving image data is large, when the moving image is transmitted as it

is, there is a problem that the delay is generated in the reception data, and the moving image data can not be reproduced in the real time. Accordingly, in order to reproduce a moving image in the real time, it is necessary that the bit rate of the moving image is lowered. Further, it is necessary that the bit rate of the moving image data is adjusted also to the bit rate at which the reception terminal equipment by which the moving image data is received, can receive. Further, even in the case where not the whole frame in the compression coded moving image data, but only a portion of the frame is quarried out and transmitted, when the bit rate of the quarried out moving image data exceeds the bit rate at which the transmission path can transmit, it is necessary that the processing to lower the bit rate is conducted. As described above, when the moving image data is transmitted through various reception terminal equipments and transmission paths, it is necessary that the bit rate of the moving image data is changed by adjusting to various bit rates, and by a time period in which it takes for the processing of the rate control, the delay is generated in the data transmission.

[0004]

Further, when the VOD server sends out a plurality of moving image data to a plurality of terminal equipments as in the case of the VOD, in proportional to the plurality of number of terminal equipments connected to the VOD server, because the rate control processing becomes heavy, and the burden onto the VOD server becomes large, the number of terminal equipments which can be simultaneously connected, are limited. That is, the bit rate control method to quickly change the bit rate of the moving image data is absolutely necessary.

[0005]

In such the case, as the conventional technique to control the bit rate of the compression coded moving image data, a method in which, initially, the moving image data is decoded into the non-compression moving image data, and coded again, and thereby the bit rate is changed, is well known. However, in this method, because the moving image data is decoded once, and further, coded again, the burden of this processing is large, and there is a problem that it is difficult to quickly change the bit rate and produce the moving image data.

[0006]

Further, as the conventional technique to lighten the re-coding processing and to increase the processing speed, a technique disclosed in JP-A- 8-23539 is well known. In Fig. 38, the structure of the conventional moving image coding apparatus is shown. In Fig. 38, a moving image coding apparatus 5001 is structured by a variable lengtgh decoding means 5002 connected to an input means 5006, a re-quantizing means 5003, a variable coding means 5004, a buffer memory means 5005, and a buffer occupation amount detecting means 5006, and is connected to an output means 5008.

[0007]

Next, an operation of the moving image coding apparatus will be described. In Fig. 38, the input means 5007 inputs the coded moving image data into the variable length decoding means 5002 for each one frame, and inputs the objective bit rate into the re-quantization means 5003. Then, the variable length decoding means 5002 conducts variable length decoding on the input data, and the quantized DCT (Discrete Cosine Transform) coefficient is found, and outputted to the re-quantization means 5003. Then, the re-quantization means 5003 re-quantizes the quantized DCT coefficient, and outputs it to the variable length coding means 5004. In this connection, the re-quantization means 5003 compares the bit rate inputted from the input means 5007 to the buffer occupation amount inputted from the buffer occupation amount detecting means 5006, and the quantization value is set so as to satisfy a predetermined bit rate, and the re-quantization is conducted. Herein, the quantization value means a value to divive the DCT coefficient in the quantization. Further, the variable length coding means 5004 conducts variable length coding on the re-quantized DCT coefficient, and supplies the moving image data which is variable length coded, to the buffer memory means 5005. The buffer memory means 5005 outputs the inputted moving image data from the variable length coding means 5004 to the output means 5008, and outputs the data amount of the moving image data to the buffer occupation amount detecting means 5006. After the buffer occupation amount detecting means 5006 adds the data amount and detects the buffer occupation amount, the total amount of the data is outputted to the re-quantization means 5003.

[0008]

As described above, when, by using the moving image coding apparatus 5001, the bit rate is controlled from the compression coded moving image data and the moving image data is newly produced, the moving image data is produced through the process in which the input moving image data is once variable length decoded, re-quantized, and variable length coded. That is, because the moving image data is decoded and coded again to the inverse quantization processing, the calculation load is large and it can be said that it is difficult to quickly conduct the rate control. Further, the moving image data is structured by a plurality of frames, and because, when the moving image data is compression coded, in order to increase the efficiency, generally, the correlation with the preceding frame by one frame in time is used, and the forecast coding between frames is used. Then, when the moving image data includes the frame on which the forecast coding between frames is conducted, the problem exists when the re-quantization is conducted by using the moving image coding apparatus.

[0009]

When the forecast coding between frames is used, the frame (Pi) on which the

re-quantization is conducted in the moving image coding apparatus 5001, is used for using for the forecast coding between frames in the subsequent frame (Pi + 1) after one frame in time, and is the frame which is necessary for addition when the (Pi + 1) is decoded.

[0010]

Then, when the re-quantization is conducted in the moving image coding apparatus 5001, because the re-quantization means changes the quantization value of the input data, the frame (Pi) before the re-quatization is conducted, differs from the frame (Pi') after the re-quantization is conducted. Accordingly, when the Pi' which is changed by the re-quantization, is added to the (Pi +1) on which the inverse quantization is conducted, and the (Pi +1) is decoded, because the difference exists between the Pi to be originally added and Pi', the decoded image is deteriorated. Hereinafter, the difference between the Pi and Pi' is called as the movement compensation error. That is, to the moving image data for which the forecast coding between frames is used, when the moving image data is produced by using the moving image coding apapratus 5001, the image quality deterioration is caused due to the movement compensation error. Further, in order to prevent the image quality deterioration, it is necessary that the frame next to the frame on which the re-quantization is conducted, is re-corded including the movement compensation, and there is a problem that the processing time is further increased.

[0011]

[Problems that the Invention is to Solve]

Problem 1:

In the conventional moving image coding apparatus, when the bit rate of the moving image data which is previously coded, is changed, and the moving image data is newly produced, it is necessary to code again after the moving image data is decoded once and re-quantized again, and it is difficult to quickly produce the moving image data.

[0012]

Problem 2:

When the conventional moving image coding apparatus is used and the rate is controlled by conducting the re-quantization, in the next frame on which the re-quantization is conducted, because the image quality deterioration due to the movement compensation error is caused, it is difficult to conduct the rate control without causing the image quality deterioration.

An object of the present invention is to solve the above 2 problems. That is, the object is that: when the bit rate of the coded moving image data is changed, and the moving image data is newly produced, the moving image data production is quickly realized without decoding the moving image data, and without causing the image quality deterioration due to the

movement compensation error.

[0013]

[Means for Solving the Problems]

In order to solve the above problems, in a moving image coding apparatus in which the previously compression coded moving image data is an input, and the new moving image data whose bit rate is different, is produced and outputted, the present invention is structured as follows.

[0014]

Firstly, the moving image data producing apparatus to produce the moving image data which is an input of the moving image data coding apparatus, is provided with a producing means for a rate correction data in which the bit amount is different to an area in which the bit generation amount in the P frame (forecast coding image between frames) is large, and which can conduct the rate change.

[0015]

According to the above description, when the moving image data is newly produced from the previously coded moving image data, by adjusting to the objective bit rate, and by selecting and replacing the rate correction data whose bit amount is different in the input moving image data, the moving image data production can be quickly conducted by changing the bit rate without decoding the moving image data. Further, by producing the rate correction data in an area in which the bit amount is large, the bit rate change can be effectively conducted. Secondly, the moving image data producing apparatus which produces the moving image data which is an input of the moving image coding apparatus is provided with a means by which the rate correction data in which the bit amount is different and the rate change can be conducted, is produced, to an area which is previously determined, and whose probability to be referred to from the next frame when the movement is forecast, is low, in the P frame (forecast coding image between frames).

[0016]

According to this, when the moving image data is newly produced from the previously coded moving data, by selecting and replacing the rate correction data whose bit amount in the input moving image data is different, by adjusting to the objective bit rate, the bit rate is changed and the moving image data can be quickly produced without decoding the moving image data. Further, by producing the rate correction data in an area whose probability to be referred to from the next frame, is low, the lowering of the forecast coding efficiency due to the influence of the search range limitation of the movement forecast can be reduced.

[0017]

Thirdly, the moving image data producing apparatus to produce the moving image data which is an input of the moving image coding apparatus, is provided with a means for producing the rate correction data whose bit amount is different, in the P frame, and provided with the movement compensation means for conducting the movement compensation without referring to from the area having the rate correction data, when the movement of the next frame is forecast.

According to this, when the moving image data is newly produced from the previously coded moving image data, even when the moving image data is produced by selecting the rate correction data whose bit amount is different, in the input moving image data, because the area is not subject to the movement forecast, the generation of the movement compensation error due to the replacement of the data can be prevented.

[0018]

Fourthly, the moving image data producing apparatus to produce the moving image data which is the input data of the moving image coding apparatus, is provided with a means for producing the rate correction data whose bit amount is different, and which can change the bit rate, to an area in which the referred degree from the next frame when the movement is forecast, is low, in the P frame.

[0019]

According to the above description, when the moving image data producing apparatus produces the moving image data, the moving image data can be produced without lowering the coding efficiency of the forecast coding between frames.

[0020]

Fifthly, the moving image data producing apparatus to produce the moving image data which is the input data of the moving image coding apparatus is provided with a means for producing the rate correction data, by removing the high frequency component of the original image, and by conducting the forecast coding between frames, to each P frame of the moving image data.

[0021]

According to the above description, when the moving image data is newly produced without decoding the previously coded moving image data, corresponding to the objective bit rate, by selecting each area of the rate correction data coded by removing the high frequency component, the fine bit rate control can be quickly conducted.

[0022]

Sixthly, the moving image data producing apparatus to produce the moving image data which is the input data of the moving image coding apparatus is provided with a means for

producing the area information showing an area of the rear portion at which the bit can be deleted, in each area, as the rate correction data.

[0023]

According to the above description, in the moving image coding apparatus which produces the new moving image data from the coded moving image data, by adjusting to the objective bit rate, when each area of the input moving image data is selected, and the rear portion bit is deleted, the bit rate control can be quickly conducted.

[0024]

Seventhly, the moving image data producing apparatus to produce the moving image data which is the input data of the moving image coding apparatus is provided with a means for producing the I frame whose bit amount is different, as the rate correction data, to each P frame.

[0025]

According to this, in the moving image coding apparatus which produces the new moving image data from the previously coded moving image data, by adjusting to the objective bit rate, and by replacing P frame of the input moving image data with the I frame whose bit amount is different which is the rate correction data, the bit rate control can be quickly conducted without decoding the input moving image data.

[0026]

Eighthly, in the case where the moving image data producing apparatus to produce the moving image data which is the input of the moving image coding apparatus is provided with a means for determining the quarry out area in each frame, and for producing the rate correction data by which the rate correction is possible, for at least an area more than one in each quarry out area in the frames, and a movement compensation means for inhibiting the movement forecast outside the area having the rate correction data in the preceding frame at the time of movement compensation and the quarry out area, when one portion in the frame is quarried out from the previously coded moving image data and the moving image data is newly produced, corresponding to the objective bit rate, by selecting the data whose bit amount is different, the bit rate is controlled and the moving image data can be quickly produced without decoding the moving image data. Further, because the movement forecast to the outside of the quarried out area is not conducted, even by using only the quarried out area of a portion of the frame, the decoding can be conducted without generating the movement compensation error.

[0027]

[Mode for Carrying Out the Invention]

By using Fig. 1 to Fig. 37, embodiments of the present invention will be described below. In this connection, the present invention is not limited to these embodiments, but in the

range not departing from the spirit of the invention, the present invention can be conducted in various modes.

[0028]

(Embodiment 1)

In the first embodiment, a moving image coding apparatus by which the rate control is conducted without decoding by using the previously compression coded moving image data, and the moving image data is newly produced, and its method will be described below.

[0029]

Initially, the moving image data producing apparatus which previously produces the moving image data which is an input of the moving image coding apparatus, will be described below.

[0030]

In Fig. 1, the structure of the moving image data producing apparatus to previously produce the moving image data having the data structure to quickly conduct the rate control, is shown.

[0031]

In Fig. 1, a moving image data producing apparatus 101 is provided with: a frame input means 117 connected to an input means 116; movement compensation means 102; DCT conversion means 103; quantizing means 104; variable length coding means 105; inverse quantizing means to conduct the decoding; inverse DCT conversion means 107; and a frame memory 108 to store the decoded frame, and is provided with: a maximum bit amount area detecting means 110 which is connected to the variable length coding means 105 and successively detects an area having the maximum bit amount; reference inhibition area memory means 109; compression frame buffer 112 connected to the DCT conversion means 103; quantization means 111 which is connected to the compression frame buffer 112 and conducts the quantization; and variable length coding means 113, and is provided with: a compression frame data combination means 114 which is connected to the variable length coding means 105, reference inhibition area memory means 109 and variable length coding means 113, and combines with the moving image data, and has the structure to be connected to an output means 115.

[0032]

The operation of the thus structured moving image data producing apparatus will be described below.

[0033]

Initially, the input means 116 inputs the non-compression image into the frame input

means 117. When the frame input means 117 receives the frame coding end signal inputted from the compression frame data combination means 114, the non-compression one frame data inputs into the movement compensation means 102. However, when the first frame data is inputted, it is independent from the frame coding end signal, and simultaneously when the data is inputted from the input means 116, the non-compression frame data is inputted into the movement compensation means 102.

[0034]

Then, when the movement compensation means 102 conducts the forecast coding between frames on the non-compression frame data inputted from the frame input means 117, after the area whose correlation is high in the preceding frame by one frame inputted from the frame memory 108 is detected, it conducts the movement compensation, and outputs the movement compensated frame data to the DCT conversion means 103. In this case, the movement compensation means 102 does not conduct the movement detection from the reference inhibition area of the preceding frame by one frame inputted from the reference inhibition area memory means 109. Further, it does not conduct the movement compensation on the data on which the coding in the frame is conducted, and the input data is outputted to the DCT conversion means as it is.

[0035]

The DCT conversion means 103 conducts the DCT conversion on the frame data which is movement compensated by the movement compensation means 102, and outputs the DCT coefficient to the quantization means 104 and the compression frame buffer 112.

[0036]

In Fig. 10, an example of the dividing method of an area in the frame is shown. Herein, the area shown in Fig. 10 is structured by an arbitrary number of macro-blocks (for example, 16 x 16 pixels), and any shape may be allowable, and is not limited to the shape shown in Fig. 10. Further, the structure of the compression frame buffer is shown in Fig. 11. The compression frame buffer respectively continuously accommodates the quantization amount and the DCT coefficient, corresponding to each area in Fig. 10.

[0037]

The quantization means 104 quantizes the DCT coefficient obtained by the DCT conversion means 103 for each area shown in Fig. 10, and the quantized DCT coefficient is outputted to the inverse quantization means 106 and the variable length coding means 105, and the quantization value used for the quantization is outputted to the compression frame buffer 112. The compression frame buffer 112 makes the DCT coefficient for one frame inputted by the DCT conversion means 103 for each area shown in Fig. 10, and the quantization value

inputted by the quantization means 104 respectively correspond to each other as shown in Fig. 11, and stores them.

[0038]

The variable length coding means 105 conducts the variable length coding on the quantized DCT coefficient, and outputs it to the maximum bit amount area detecting means 110 and the compression frame data combination means 114. Herein, the data which is coded by the variable length coding means 105 is called the normal frame data.

[0039]

Further, the inverse quantization means 106 conducts the inverse quantization on the DCT coefficient quantized by the quantization means 104, and outputs it to the inverse DCT conversion means 107. The inverse DCT conversion means 107 conducts the inverse DCT conversion on the DCT coefficient obtained in the inverse quantization means 106, and outputs it to the movement compensation means 102. The movement compensation means 102 decodes the frame by using the inverse DCT converted coefficient and the decoding frame which is the preceding frame by one frame inputted by the frame memory, and renews the decoding frame of the frame memory. However, for the I frame, the inverse DCT converted frame is stored in the frame memory as it is.

[0040]

As described above, in the variable length coding means 105, when the coding of one frame is completed, the maximum bit amount detecting means 110 detects a predetermined number of areas in order of area having the larger bit amount from the area including the maximum bit amount, in the frame coded by the variable length coding means 105, and outputs the rate correction area data showing the detected areas to the reference inhibition area memory means 109 and the compression frame buffer 112. In Fig. 12, an example of the rate correction area data is shown. In Fig. 12, a black area shows the selected areas by the frame maximum bit area detecting means, and this area is defined as the reference inhibition area.

[0041]

The reference inhibition area memory means 109 outputs the correction area data showing the detected area by the maximum bit amount area detecting means 110 to the movement compensation means 102 and the moving image data combination means 114. Then, the compression frame buffer 112 cuts out the DCT coefficient and the quantization value of the area corresponding from the inside of the compression frame buffer, to the reference inhibition area of the correction area data inputted by the maximum bit amount area detecting means 110, and outputs them to the quantization means 111. The quantization means 111 conducts the quantization by using a plurality of quantization value s before and after the

quantization value s inputted from the compression frame buffer 112, on the DCT coefficient inputted from the compression frame buffer 112, and outputs it to the variable length coding means 113.

[0042]

In the quantization means 111, when the quantization is conducted by using the different quantization value , the data whose bit amount is different can be produced.

[0043]

For example, when the quantization is conducted by the quantization value $Q = 2$, on the input stream in which an image plane size is CIF (352 x 288) and the frame rate is 30 fps, and the MPEG 4 stream is made, the bit rate is about 1.6 Mbps, and like as at $Q = 6$, about 384 kbps, at $Q = 16$, about 128 kbps, and at $Q = 30$, about 56 kbps, the data whose bit rate is different, can be produced corresponding to the quantization value Q.

[0044]

The variable length coding means 113 conducts variable length coding on the DCT coefficient quantized by the quantization means 111, and produces the correction data, and produces the rate correction data having the number of areas, the number of correction data of each area, the area number and the data size of respective correction data as the header information, and outputs it to the compression frame data combination means 114. Herein, the data produced by the variable length coding means 113 is defined as the rate correction data. In Fig. 15, the structure of the rate correction data is shown, and the content of the rate correction data is shown in Fig. 16. Further, the structure of the rate correction data header is shown in Fig. 17. In Fig. 17, the rate correction data header 1502 has a structure in which the number in each area of the correction data whose bit amount is different, which is produced by changing the number of areas and the quantization value, and the area number and the bit amount of respective correction data are stored as the fixed length data. Herein, the order of areas is defined as the order in which the bit amount is larger. Then, in Fig. 15, the rate correction data has the structure in which the correction data is stored succeeding to the rate correction data header 1502 in order of the area in which the bit amount of the correction data is larger. The structure of the compression frame data is shown in Fig. 13. In Fig. 13, the compression frame data has a structure in which the rate correction area data and the rate correction data are successively stored after the normal frame data.

[0045]

The compression frame data combination means 114 stores the normal frame data inputted by the variable length coding means 105, the correction area data inputted by the reference inhibition area memory means 109, and the rate correction data inputted by the

variable length coding means 113 in order as shown in Fig. 13, and outputs them as the compression frame data 1301 to the output means 115, and outputs the frame coding end signal showing that the coding of one frame is completed, to the frame input means 117. The structure of the moving image data is shown in Fig. 14. In Fig. 14, the moving image data 1401 has a structure in which the compression frame data is successively stored.

[0046]

Thus coded moving image data 1401 has a structure in which, for each frame, the normal frame data, the rate correction area data showing the area in which the rate correction data exists, and the rate correction data whose bit amount is different, are arranged in order. Then, the area having the rate correction data, that is, the reference inhibition area inhibits the reference from the next frame at the time of movement forecast, and because it is in the condition that the movement forecast is not received from the next frame, even when the data of this area is replaced with the rate correction data and the bit rate change is conducted, the movement compensation error is not generated when the next frame is decoded.

[0047]

Next, the structure of the moving image coding apparatus by which the moving image data coded by the moving image coding apparatus shown in Fig. 1 is used as the input data, and the rate control is conducted without decoding the input data, and the rate changed moving image data is newly produced, is shown in Fig. 2.

[0048]

In Fig. 2, the moving image coding apparatus 201 has a data separation means 207 connected to an input means 202, bit amount calculation means 203, rate correction data selection means 204, bit rate control means 205 and moving image combination means 208, and has a structure in which it is connected to an output means 206.

[0049]

The operation of thus structured moving image coding apparatus will be described below. In Fig. 2, the input means 202 inputs the compression coded moving image data 1301 and the objective bit rate which is determined by the user, to the data separation means 207. When the data is inputted by the input means 292, the data separation means 207 inputs the objective bit frame by each one frame to the bit rate control means 205, and further, takes out the data in order from the leading data of the inputted moving image data, and inputs the normal frame data for each one frame to the bit amount calculation means 203, and inputs the rate correction area data and the rate correction data for each one frame to the rate correction data selection means 204. Herein, when the input means 202 inputs the frames other than the first one frame of the moving image data, after the frame coding end signal is received from the rate

correction data selection means 204, it conducts the respective data input.

[0050]

The bit amount calculation means 203 calculates the bit amount of the inputted normal frame data, and outputs the bit amount to the bit rate control means 205, and outputs the normal frame data to the rate correction data selection means.

[0051]

The bit rate control means 205 compares the objective bit rate inputted from the inputted means 202 to the current bit amount inputted from the bit amount detecting means 203, and the insufficient bit amount necessary for satisfying the objective bit rate, or sufficient bit amount is obtained, and is outputted to the rate correction data selection means 204.

[0052]

The rate correction data selection means receives the bit amount which is a bit rate error, inputted by the bit rate control means 205, and in order to satisfy the objective bit rate, to the area shown by the rate correction area data inputted by the data separation means 207, it compares the bit amount of the area in the normal frame data to the bit amount of the plurality of correction data stored in the rate correction data header 1502, and when the data is replaced, the correction data by which the bit rate error becomes small, is selected in order of stored areas, and by replacing the data in the normal frame data with selected correction data, the bit amount is changed. Further, when the bit amount error is large, the correction data is selected from the next area, and by replacing the data, the bit amount is changed. By repeating the above processing, the moving image data in which the bit amount error is made minimum, is outputted to the moving image data combination means 208, and one frame coding end signal is outputted to the data separation means 207.

[0053]

The moving image data combination means 208 connects the frame data inputted for each frame from the rate correction data selection means 204 in order, and produces the moving image data and outputs to the output means 206.

[0054]

Herein, when the area is selected by the rate correction data selection means 204 and the data is replaced corresponding to the bit amount, there is a problem that the movement compensation error is caused by the replacement of the data which is referred to as the movement compensation after I frames in the conventional method, and the image quality deterioration is caused, however in the present invention, because the reference to the area having the rate correction data is inhibited by the reference inhibition area memory means 109 in the moving image data producing apparatus in Fig. 1, even when the correction data is

selected and replaced, the movement compensation error is not caused. Accordingly, the rate control can be quickly conducted by selecting the correction data without decoding the moving image data and without causing the image quality deterioration due to the movement compensation error.

[0055]

Further, in the present embodiment, the number of areas detected by the maximum bit area detecting means 110 is determined by the user corresponding to, to what % the bit rate of the input data can be changed, and the larger the number of areas is, the larger the range of the bit rate change is. However, when the number of areas is increased, because the reference area used for the movement forecast becomes narrow, the coding efficiency is lowered. In order to solve the problem, the maximum bit area detecting means 110 detects the area from the area having the maximum bit in the order in which the bit amount is larger. It is because the compression coded data does not always have a uniform bit amount in the frame, and there are cases where the area having the larger bit amount exists locally, and when the correction data is provided to such the area in which the bit amount is large, the bit rate change becomes easy, and the reference inhibition area can be reduced.

[0056]

Further, the number of rate correction data of each area selected by the maximum bit area detecting means 110 and the value of respective quantization value also contribute to the width of the bit rate change. For example, when the quantization of the normal frame data is conducted at Q = 6, the bit rate is about 384 kbps, and as the area having the rate correction data, a plurality of areas having the data amount of about 3/4 of the whole in total are selected from the areas whose bit amount is large. When the deviation of the bit is considered, an area of the areas is lower than 3/4. For these areas, by using the quantization values Q = 2, Q = 30, 2 kinds of rate correction data of about 1.6 Mbps, and about 56 kbps are produced. Whole data size including the rate correction data is about 1.6 Mbps. When the moving image data including the rate correction data is combined with the rate correction data, the bit rate change can be arbitrarily conducted in the range of about 1.5 Mbps to about 64 kbps, and the moving image data matched with bit rates of various transmission paths can be produced.

Further, the calculation cost relating to the rate change is low, and a plurality of streams in which bit rates are different, can be quickly produced. Further, when the stream whose bit rate is different is prepared from the initial time, the bit rate is fixed and its data size becomes large. Comparing to that case, in the present embodiment, it is enough when the data size is slightly larger than the maximum bit rate which is presumed.

[0057]

As described above, in the present embodiment, the movement compensation means which does not conduct the movement compensation from the reference inhibition area, and the moving image data producing apparatus which produces the moving image data having together the rate correction data, and the area selection means which selects the rate correction data corresponding to the bit rate, are provided, thereby, the apparatus can quickly conduct the rate control without decoding the moving image data, and without causing the image quality deterioration due to the movement compensation error, and can quickly produce a plurality of streams in which the bit rate is different, thereby, its practical effect is large.

[0058]

(Embodiment 2)

In the second embodiment, an apparatus in which the rate control is conducted from the previously coded moving image data without being decoded, and the moving image data is newly produced, and which is characterized in that, as the area selection method to produce the rate correction data, the known area which is hardly referred to at the time of movement forecast, is used, will be described below.

[0059]

In the present embodiment, the moving image coding apparatus by which the rate change is conducted from the previously coded moving image data, and moving image data is newly produced, is the same as in Embodiment 1.

[0060]

A moving image data producing apparatus by which the moving image data which is an input of the moving image coding apparatus to quickly conduct the rate control, is previously produced, will be described below.

[0061]

In Fig. 3, the structure of the moving image data producing apparatus by which the moving image data having the data structure to quickly conduct the rate control is produced, is shown.

[0062]

In Fig. 3, the moving image data producing apparatus 301 is provided with: a frame input means 117 connected to an input means 116; movement compensation means; DCT conversion means 103; quantization means 104; variable length coding means 105; inverse quantization means 106 for conducting the decoding; inverse DCT conversion means 107; and frame memory 108 for storing the decoded frame, and the apparatus is connected to the variable length coding means 105, and is provided with: the rate correction area selection means 310 for selecting the area producing the rate correction data; reference inhibition area memory means

109; compression frame buffer 112 to connect to the DCT conversion means 103; quantization means 111 to connect to the compression frame buffer and to conduct the quantization; and variable length coding means 113, and is connected to the variable length coding means 105, reference inhibition area memory means 109, and variable length coding means 113, and is provided with a compression frame data combination means 114 to combine the moving image data, and has a structure which is connected to an output means 115.

[0063]

Operations of thus structured moving image coding apparatus will be described below. In Fig. 3, operations other than the rate correction selection means 310 are entirely the same as in Embodiment 1. In Fig. 3, the variable length coding means 105 conducts the variable length coding on the quantized DCT coefficient inputted from the quantization means 104 in the same manner as in Embodiment 1, and outputs it to the rate correction area selection means 310 and the compression frame data combination means 114. Herein, the data coded by the variable length coding means 105 is called the normal frame data.

[0064]

As described above, when the coding of the normal frame data is completed, the rate correction data area selection means 310 selects the area for the rate correction from the frame coded in the variable length coding means 105, and outputs the rate correction area data 1201 showing the selected area as shown in Fig. 12, to the reference inhibition area memory means 109 and the compression frame buffer 112. Herein, the area selected as the rate correction area is an area to which the probability to be referred from the next frame at the time of the movement forecast, is low, for example, such as a rim portion of the frame, and is defined as the known area which is previously stored in the rate correction data area selection means 310.

[0065]

In the present embodiment, it is inhibited that the area for rate correction is referred to at the time of movement forecast, and by inhibiting the reference, because the search area at the time of movement forecast is small, there is a possibility that the forecast coding efficiency is lowered. Therefore, the area which is hardly referred to at the time of movement forecast, is defined in such a manner that it is selected as the rate correction area. Thereby, even when the search area at the time of movement forecast becomes small, because the area has the small probability to be originally referred to, the practical search area is not small, that is, the forecast coding efficiency can be prevented from lowering. Operations after the compression frame buffer 112 are the same as in Embodiment 1.

[0066]

Thus coded moving image data has the structure having, to each frame, the

compression coded normal frame data, rate correction area data showing the area in which the rate correction data exists, and rate correction data including a plurality of correction data whose bit amount is different, and the area having the rate correction data is in the condition that it is not referred to at the time of movement forecast from the next frame.

[0067]

As described above, when the coded moving image data is an input, and by using the moving image coding apparatus shown in Fig. 2, in the same manner as in Embodiment 1, the rate correction data corresponding to the objective bit rate is selected, and it is replaced with the data in the normal frame data, by producing the new moving image data, the rate control can be quickly conducted without decoding the data.

[0068]

Further, the area to produce the rate correction data is defined as the known area, such as the rim portion of the frame which is hardly referred to at the time of movement forecast, and the size of the area can be determined by the user corresponding to the range of the change of the bit rate. Further, the number of the rate correction data and the quantization value in each area also contribute to the width of the bit rate change.

[0069]

For example, when the quantization of the normal frame data (size: CIF, frame rate 30 fps) is conducted at Q = 24, the bit rate becomes about 100 kbps. To this. the area of the size of total of about 40 % at the ratio of the area of the frame, in which the movement forecast is hardly conducted, is defined as the rate correction data area, and on respective area data, the quantization is conducted at the two quantization values Q = 16 and 31, and the rate correction data having the bit rate corresponding to about 128 kbps, and about 32 kbps are produced. With the moving image data having these rate correction data, when the rate correction data is combined, the bit rate can be arbitrarily changed between about 128 kbps and about 64 kbps, and the moving image data corresponding to the fluctuation of the band of the transmission path can be quickly produced. Further, the calculation cost according to the bit rate change is low, and a plurality of moving image data whose bit rate is different, can be quickly produced.

[0070]

In the present embodiment, the range of the bit rate change is smaller as compared to Embodiment 1, but the present invention is characterized in that, because the area which is set as the reference inhibition area, has the character which is hardly forecast, the lowering of the coding efficiency can be prevented. Further, the data size of the moving image data is about 128 kbps, and almost equal to the maximum value of the bit rate change.

[0071]

As described above, in the present embodiment, when the moving image data producing apparatus in which a plurality of rate correction data whose bit amount are different, are produced, to the area to which the probability to be referred at the time of movement forecast is low, and the control means which is matched with the objective bit rate, and selects the rate correction data, and conducts the rate control, are provided, because the forecast coding efficiency at the time of movement forecast is not lowered, and the rate control can be quickly conducted without causing the image quality deterioration due to the movement compensation error, a plurality of moving image data whose bit rates are different, can be quickly produced, thereby, its practical effect is large.

[0072]

(Embodiment 3)

In the third embodiment, the moving image data producing apparatus in which the rate control is conducted from the previously coded moving image data without being decoded, and the moving image data is newly produced, wherein the apparatus has, to the moving image data, by using the referred degree at the time of the movement forecast, a means for selecting the rate correction area to produce a plurality of data in which the bit amount is different, will be described below.

[0073]

Further, in the present embodiment, the moving image coding apparatus in which the rate control is conducted from the previously coded moving image data, and the moving image data is newly produced, is entirely the same as in Embodiment 1.

[0074]

The structure of the moving image data producing apparatus is shown in Fig. 4. In Fig. 4, a moving image data producing apparatus 401 has: a frame input means 117 connected to an input means 116; movement compensation means 402; DCT conversion means 103; quantization means 104; variable length coding means 105; inverse quantization means 105 for decoding; inverse DCT conversion means 107; and frame memory 108 for storing the decoded frame, and a referred area memory means 410 connected to a movement compensation means 402; and a rate correction area selection means 412, and a compression frame buffer 112 connected to a DCT conversion means 404; quantization means 111; and variable length coding means 113, and a rate correction area selection means 412; compression frame combination means 414 connected to the variable length coding means 113 and variable length coding means 105, and has a structure in which these means are connected to the output means 115.

[0075]

Operations of thus structured moving image producing apparatus will be described

below. In the moving image coding apparatus 401, the input means 116, frame input means 117, DCT conversion means 103, quantization means 104, variable length coding means 105, inverse quantization means 106, inverse DCT conversion means 107, and frame memory 108 produce the normal frame data in entirely the same manner as in Embodiment 1. In this connection, the variable length coding means 405 outputs the frame coding end signal to the frame input means 117 when the normal frame data producing is completed. In this manner, when the normal frame data for one frame is produced, the frame input means 117 outputs the next non-compression frame to the movement compensation means 402.

[0076]

The movement compensation means 402 does not conduct the movement compensation on the I frame, and outputs to the DCT conversion means 103, and in the case of other than I frame, the movement compensation is conducted by using the preceding frame by 1 frame and the frame inputted by the frame input means 117. Further, in the preceding frame by 1 frame, the area information which is referred to at the time of movement forecast, is outputted to the referred area memory means 410.

[0077]

The referred area data is shown in Fig. 18. The referred area data is the data in which the referred degree of each area is stored. In the referred area data, the referred degree of each area means that, in pixels in the area, total pixel number which is referred to at the time of movement forecast from the next frame, is shown, and in Fig. 18, it is defined that the thicker the color of the area is, the higher the referred degree is.

The referred area memory means 410 stores the referred area inputted from the movement compensation means 403, and outputs the referred area data showing the referred area to the rate correction area selection means 412.

[0078]

The rate correction area selection means 412 selects, in the inputted referred area data, a predetermined number of areas in the order from the area in which the referred area is low, as the rate correction data area. Further, the selected area is the rate correction area in the preceding frame by one frame to the frame currently inputted by the frame input means, and outputs the rate correction area data 1201 showing the selected rate correction area to the compression frame buffer 112 and the moving image data combination means 414. Further, the operation of the compression frame buffer 112, quantization means 111, and variable length coding means 113 is the same as in Embodiment 1.

[0079]

The compression frame combination means 414 combines the normal frame data

inputted from the variable coding means 405, the rate correction area data inputted from the rate correction area selection means 412, and the rate correction data inputted from the variable length coding means 113 as shown in Fig. 13, and outputs it to the output means 115. In the present embodiment, because it is not conducted that the reference inhibition area is set at the time of movement forecast and the search area is limited, as shown in Embodiments 1 and 2, the search area is not limited, and the forecast coding effect can be more enhanced than in Embodiments 1 and 2.

[0080]

By using the coded moving image data as an input as described above, and the moving image coding apparatus in Fig. 2, when the new moving image data is produced in the same manner as in Embodiment 1, the rate control can be quickly conducted without decoding the data. Further, because, as the area having the rate correction data, the area to which the referred degree is low at the time of movement forecast, is selected, even when the rate correction data is selected at the time of the rate control, the movement compensation error is not caused. Further, the number of area to be selected in the order from the area in which the referred degree is lower, can be determined by the user corresponding to the range of the bit rate change. Further, the number of rate correction data and the quantization value in respective areas also contribute to the width of the bit rate change.

[0081]

For example, when the quantization of the normal frame data (size: CIF, frame rate 30 fps) is conducted at Q = 24, the bit rate is about 100 kbps. In contrast to this, the area in which the referred degree is low and the size is the total of about 30 % in the area ratio of the frame, is defined as the rate correction data area, and to respective areas, the quantization is conducted at two quantization values of Q = 16 and 32, and the rate correction data having the bit rate corresponding to about 128 kbps and about 32 kbps is produced. With the moving image data having this rate correction data, when the rate correction data is combined, the bit rate can be arbitrarily changed between about 128 and about 64 kbps, the moving image data corresponding to the fluctuation of the band of the transmission path can be quickly produced. Further, the calculation cost according to the bit rate change is low, and a plurality of moving image data whose bit rate are different, can be quickly produced. Further, the data size of the moving image data is about 128 kbps, and it is almost equal to the maximum value of the bit rate change. In this example, the range of the bit rate change is smaller than in Embodiment 1, however, because the reference inhibition area is not provided, the lowering of the coding efficiency can be prevented, and because the area having the rate correction data is an area to which the practical referred degree is low, the generation of the movement compensation error which

accompanies the replacement of the data can be suppressed to small.

[0082]

As described above, in the present embodiment, the moving image data structure having the rate correction data to the area to which the referred degree is low at the time of movement forecast, and the moving image data producing apparatus which selects the rate correction data and changes the bit rate, are provided, and thereby, because the forecast coding efficiency of the movement forecast is not lowered and the movement compensation error generated when the rate correction data is used is lowered, and the rate control can be quickly conducted, a plurality of moving image data whose bit rates are different, can be quickly produced, and its practical effect is large.

[0083]

(Embodiment 4)

In the fourth embodiment, in an apparatus by which the previously coded moving image data is not decoded, and the rate control is conducted, and the new moving image data is produced, the apparatus characterized in that the input moving image data has the rate correction data whose bit amount is slightly different, on the entire frame, will be described below.

[0084]

In Fig. 5, the structure of the moving image data producing apparatus by which the coding is previously conducted for the input data of the moving image coding apparatus to conduct the rate control, is shown. In Fig. 5, the moving data producing apparatus 501 is provided with: the frame input means 117 connected to the input means 116; movement compensation means 102; DCT conversion means 103; quantization means 104; and variable length coding means 105, and is provided with the inverse quantization means 106 for conducting the decoding; inverse DCT conversion means 107; and frame memory 108. Further, the moving image coding apparatus 501 is provided with: a low pass filter 503 connected to the frame input means 117; movement compensation means 102 connected to the low pass filter 503; DCT conversion means 103; quantization means 104; and variable length coding means 106, and is provided with: the inverse quantisation means 106 which is connected to the quantization means 104 and conducts the decoding; inverse DCT conversion means 107; and frame memory 108. Further, the moving image data producing apparatus 501 is structured in such a manner that it is connected to the variable length coding means 105, the compression frame data combination means 504 connected to the variable length coding means 105, and output means 115.

[0085]

The operation of thus structured moving image data producing apparatus will be described below. In the moving image coding apparatus 501, teh frame input means 117, movement compensation means 102, DCT conversion means 103, quantization means 104, variable length coding means 105, inverse quantization means 106, invesr DCT conversion means 107, and frame memory 108 are blocks for producing the normal frame data in the same manner as in Embodiment 1.

[0086]

Further, in Fig. 5, the low pass filter 503 causes the non-compression frame to pass through the low pass filter, reduces the high frequency information of the input frame, and outputs it to the movement compensation means 102. Hereinafter, by using the DCT conversion means 103, quantization means 104, variable length coding means 506, inverse quantization means 106, inverse DCT conversion means 107, and frame memory 108, in the same manner as in the normal frame data production, by using the same quantization value, the frame data is produced. In this connection, the frame data produced herein is the data produced in such a manner that the data in which the high frequency of the input frame is reduced by the low pass filter 503, is coded, and is the data in which its bit amount is fewer than the normal frame data, and has the structure in which it has the correction data to the whole area in 1 frame shown in Fig. 10, and this data is called the rate correction data. The variable length coding means 506 calculates, to the rate correction data, the rate correction data header as shown in Fig. 20, and outputs the rate correction data and the rate correction data header to the moving image combination means 20. The rate correction data header has the structure having the number of areas in the rate correction data 1 frame, and the bit amount in each area.

[0087]

The compression frame data combination means 504 combines the normal frame data inputted from the variable length coding means 105, rate correction data header inputted from the variable length coding means 506, and rate correction data as shown in Fig. 19, and outputs it to the output means 115.

[0088]

As described above, in the present embodiment, the structure having the rate correction data is applied to all areas of 1 frame, and respective data amounts of the normal frame outputted from the variable length coding means 105, and the rate correction data outputted from the variable length coding means 106, are slightly different, by reducing the high frequency component of the non-compression frame.

[0089]

The structure of the moving image coding apparatus in which the moving image data

coded as described above is an input, and the rate control is conducted without decoding the data, and the moving image data is newly produced, is shown in Fig. 21. In Fig. 21, the moving image coding apparatus 2101 is provided with: the data separation means 207 connected to the input means 202; bit amount calculation means 203; rate correction data selection means 2104; bit rate control means 205; and moving image data combination means 208, and the apparatus has the structure in which these are connected to the output means 206.

[0090]

The operation of thus structured moving image coding apparatus 2101 will be described below. In Fig. 21, the operations of blocks other than the rate correction data selection means 2104 are entirely the same as in Embodiment 1. The rate correction data selection means 2104 conducts, by using the bit rate error inputted from the bit rate control means 205, rate correction data header inputted from the data separation means 207, rate correction data, and normal frame data inputted from the bit amount calculation means 203, the rate control so that the bit rate error is reduced. A flow of the processing of the rate control is shown in Fig. 22.

[0091]

As shown in Fig. 22,

STEP 1: initially, the positive or negative of the bit rate error is judged, and when it is negative or zero, the sequence is completed, and when it is positive, that is, bit is excessive,

STEP 2: the rate correction data header is referred to, and the maximum area of the bit amount is selected.

STEP 3: to the selected area, the normal frame data is replaced with the rate correction data.

STEP 4: after the data is replaced, the bit rate error is renewed, and the sequence advances to the bit rate error judgement process.

[0092]

The above processing is repeated until the bit rate error becomes negative, and when the processing is completed, the frame data is outputted to the moving image data combination means. The moving image data combination means 208 connects the frame data inputted for each 1 frame in order, and the moving image data is produced, and outputted to the output means 206.

[0093]

In the present embodiment, after the rate correction data passes through the low pass filter, because it is quantized at the same quantization value as the normal frame, there is only a little difference in the bit amount, as compared to the normal data which is coded without low pass filter, and by selecting the rate correction data to a plurality of areas, the fine rate control

can be conducted.

[0094]

The frequency characteristic of this low pass filter can be determined by the user corresponding to the range of the bit rate change. For example, in the case where the low pass filter having the frequency characteristic in which the coding data after the passage of the low pass filter is 64 kbps, is used to the moving image data in which the bit rate after the coding is 128 kbps, when the input data is 128 kbps, the moving image data in which the fine bit rate change is possible in the range between 128 kbps and about 64 kbps, can be produced. Further, the calculation cost which accompanies the bit rate change is low, and thereby, a plurality of moving image data whose bit rates are different, can be quickly produced.

[0095]

Further, because the difference of the image quality in the rate correction data and the normal data are small as compared to the case where the image data is produced by changing the quantization value as in Embodiments 1, 2 and 3, the present embodiment is characterized in that the movement compensation error caused by selecting the rate correction data is small.

[0096]

As described above, in the present embodiment, to the whole areas in the frame, the moving image data structure having together the rate correction data which is produced by removing the high frequency and being coded, and the moving image coding apparatus by which the rate correction data is selected corresponding to the objective bit rate, and the rate control is conducted, are provided, thereby, because, while the movement compensation error is reduced, the fine rate control can be quickly conducted, a plurality of moving image data whose bit rates are different, can be quickly produced, and its practical effect is large.

[0097]

(Embodiment 5)

In the fifth embodiment, in the apparatus by which the rate control is conducted from the previously coded moving image data, without decoding the data, and the moving image data is newly produced, the apparatus characterized in that the input moving image data has the data structure in which the bit reduction is possible at the time of rate control, will be described below. The present apparatus is structured by 2 apparatus of the moving image data producing apparatus in which the moving image data is previously coded, and the moving image coding apparatus in which the rate control is conducted, and the moving image data is produced.

Initially, the moving image data producing apparatus by which the moving image data having the structure in which the bit reduction is possible at the time of rate control, is produced, will be described, and next, the moving image coding apparatus by which the rate control is

conducted and the moving image data is produced, will be described.

[0098]

In Fig. 6, the structure of the moving image data producing apparatus is shown. In Fig. 6, a moving image data producing apparatus 601 is provided with: a moving image coding means 603 connected to an input means 602; a data dividing position selection means 605 for selecting the dividable position in the data of the Video Packet structured by continuous arbitrary number of macro blocks; video Packet termination data producing means 606; and rate correction data producing means 607 for storing the information for the rate correction, and is provided with moving image data combination means 608 connected to the Video Packet producing means 604 and rate correction data producing means 607, and has the structure in which these are connected to an output means 609.

[0099]

The operation of the moving image data producing apparatus 601 structured as above will be described below. Initially, the input means 602 inputs the non-compression image into the moving image coding means 603 for each 1 frame. Then, the moving image coding means 603 conducts the movement compensation, DCT conversion, quantization, and variable length coding processing on the inputted frame in the Video Packet unit structured by the continuous arbitrary macro block. Further, the moving image coding means 603 stores respective start positions of the final macro block for each Video Packet at the time of the coding, and produces the Video Packet structure data. The Video Packet structure data is shown in Fig. 36. In Fig. 36, the Video Packet structure data records the total number of the Video Packet, and the start position of the final macro block in respective Video Packets.

[0100]

Then, the moving image coding means 603 outputs the coded Video Packet to the data dividing position selection means 605 and the moving data combination means 608, and outputs the Video Packet structure data to the data dividing position selection means 605. Herein, the Video Packet may have the same structure as in the area shown in, for example, Fig. 10, but, it is necessary that each Video Packet is structured by the continuous macro blocks in the lateral direction.

[0101]

The data dividing position selection means 605 selects the area which can be deleted at the time of rate control for the respective final macro blocks of the inputted Video Packet, and determines its border as the dividing position of the Video Packet. In each Video Packet, the continuous macro block is accommodated in order, and in each macro block, because the variable length sign of the quantized DCT coefficient is accommodated in order from the low

frequency side, in the final macro block of the Video Packet, the variable length sign of the rear side corresponds to the DCT coefficient of the high frequency. Accordingly, as shown in Fig. 23, the final macro block of the Video Packet is divided at the time of rate control, and the position to delete the subsequent data is selected from the rear side of the final macro block of each Video Packet. That is, the data dividing position selection means 605 causes the DCT coefficient of the high frequency accommodated in rear side of the final macro block of the Video Packet to be the area which can be deleted. Further, because the high frequency component is smaller, as compared to the low frequency component, in the influence onto the image quality even when the information is deleted, the deterioration of the image quality by deleting the high frequency component is small. Then, the data dividing position selection means 605 outputs the information of the selected position, and its bit amount and the subsequent to the rate correction data producing means 607, and outputs the information of the selected position and each Video packet to the Video Packet termination data producing means 606.

[0102]

The Video Packet termination data producing means 606 calculates, to the first variable length sign beginning from the position selected by the data dividing position selection means 605, the variable length sign when the sign is the last of the Video Packet, and further, as shown in Fig. 24, produces the Video Packet termination data to which the stuffing bit for byte alignment when it is the last of the Video Packet, is added, and outputs it to the rate correction data producing means 607. Herein, the Video Packet termination data itself is also added by the stuffing bit for adjusting the byte alignment. Then, the rate correction data producing means 607 collects the divided position inputted by the data dividing position selection means 605, the bit amounts subsequent to the position, the Video Packet termination data inputted by the Video Packet termination data producing means 606, as the rate correction data, and output it to the compression frame data combination means 608. Fig. 25 is a view showing the rate correction data structure and rate correction data header structure in the present fifth embodiment. Further, Fig. 26 is a view showing the data content of the rate correction data shown in Fig. 25. The rate correction data has the structure, as shown in Fig. 25 and Fig. 26, consisting of the rate correction data header, and a plurality of Video Packet termination data, and the rate correction data header has the structure including the Video Packet number of 1 frame, bit number showing the divided position of each Video packet, bit amounts which can be deleted, subsequent to the divided position, and bit amount of the Video Packet termination data.

[0103]

Finally, the moving image data combination means 608 combines the normal Video Packet inputted by the Video Packet producing means 604 for each 1 frame, and the rate correction data inputted by the rate correction data producing means 607 for each 1 frame, in order, and produces the moving image data, and outputs it to the output means 609.

[0104]

Next, the moving image coding apparatus which conducts the rate control and produces the moving image data from the moving image data produced by the moving image data producing means, will be described.

[0105]

The structure of the moving image coding apparatus is shown in Fig. 7. In Fig. 7, the moving image producing apparatus 701 has a rate correction data extraction means 703 connected to an input means 702, data composition means 704, and rate correction means 706, and a bit rate control means 705 connected to the input means 702, rate correction data extraction means 703, and data composition means 704, and has the structure connected to an output means 707. The operation of the structured as described above, will be described below. The moving image producing apparatus 701 has the moving image data outputted by the output means 609 as an input, and conducts the rate change and newly produces the moving image data.

[0106]

The input means 702 inputs the coded moving image data including the Video Packet for each 1 frame to the rate correction data extraction means 703, and the objective bit rate into the bit rate control means 705. The rate correction data extraction means 703 extracts the rate correction data from the inputted moving image data, outputs it to the bit rate control means 706, and outputs the normal Video Packet other than the rate correction data to the data composition means 704. The data composition means 704 combines the inputted Video Packets and composes the frame data, and outputs the generated bit amount to the bit rate control means 705, and outputs the composite frame data to the rate correction means 706. Further, the bit rte control means 705 compares the objective bit rate inputted from the input means 702 to the generated bit amount inputted from the data composition means 704, and calculates the bit rate error, and to satisfy the objective bit rate, when the bit amount is excessive, refers to the rate correction data header in the rate correction data inputted from the rate correction data extraction means 703, and selects from which position Video Packet the bit is deleted, and outputs the correction data corresponding to the rate correction data header showing the position, to the rate correction means 706. Herein, the selection method of the Video Packet to delete the bit, is as follows: the Video Packet is selected in the order of the Video Packet in which the

bit amount to be deleted in the rate correction data header is larger, and the bit is deleted, and the bit amount which can be deleted, is the differentiated from the bit rate error, and by adding the bit amount of the termination data, the bit rate error is renewed, and the selection processing is continued until the objective bit rate is satisfied.

[0107]

The rate correction means 706 deletes the bits subsequent to the bit position which can be deleted, accommodated in the rate correction data header, for the Video Packet inputted by the bit rate control means 705, and the Video Packet termination data inputted by the rate control means 706 is inserted instead of them, and the frame data which is rate corrected, is outputted to the output means 707. The output means 707 composes the moving image data inputted for each 1 frame from the rate correction means 706, and produces the moving image data.

[0108]

As described above, to delete the rear portion bit of the final macro block of the Video Packet so that rate correction is conducted, is equivalent to that the high frequency component of the final macro block of the Video Packet is removed, and has the same effect as a case that the variable length decoding and re-quantization are conducted, and the bit rate is lowered. Further, because the decoding processing is not necessary, the processing is light and the rate control can be quickly conducted. [0109]

Further, the number of the rate correction data is equal to the number of the Video Packet, and the number of the Video Packet can be set by the user corresponding to the range of the bit rate change. For example, in the case where the size of 1 Video Packet is several % of the whole frame, which is small, and the data amount of the rear portion bit which can be deleted, corresponds to about 10 % to the data amount of 1 Video Packet, when the input data is about 64 kbps, the data in which the bit rate can be changed in the range of about 64 kbps to about 56 kbps, can be produced. Thereby, in order to cope with the fluctuation of the network, the bit rate change can be quickly conducted. Further, the present embodiment is characterized in that the rate correction data may be smaller, as compared to Embodiments 1 to 4.

[0110]

As described above, in the present embodiment, the Video Packet structure whose rear portion bit can be deleted, the moving image data structure having the rate correction data in which the position information and termination data are stored, and the moving image coding apparatus which refers to the rate correction data and deletes the bits of rear portion of the Video Packet and conducts the rate control, are provided, thereby, the rate control can be quickly conducted without decoding the moving image data, and its practical effect is large.

[0111]

(Embodiment 6)

In the sixth embodiment, in the moving image coding apparatus in which the rate control is conducted from the previously coded moving image data without decoding the data and the moving image data is newly produced, the moving image coding apparatus characterized in that the input moving image data has, as the rate correction data, the structure having the I frame which is the coded image in the frame whose bit amount is different to the normal frame, will be described below. Initially, the moving image data producing apparatus in which the moving image data which is an input of the moving image coding apparatus, is produced, will be described, and next, the moving image coding apparatus by which, from the moving image data coded by the moving image data producing apparatus, the rate control is conducted without decoding the data, and the moving image data is newly produced, will be described below.

[0112]

In Fig. 8, the structure of the moving image data producing apparatus to produce the input moving image data of the moving image coding apparatus is shown. The moving image data producing apparatus 801 is provided with a frame input means 808 connected to the input means 802, P frame coding means 803, and bit amount buffer 804, and is provided with a frame input means 808, and I frame coding means 805 connected to the bit amount buffer 804, and further, is provided with a compression frame data combination means 809 connected to the P frame coding means 803 and I frame coding means 805, and a moving image data combination means 806, and has the structure connected to an out put means 807.

[0113]

The operation of the moving image data producing means structured as described above will be described below. The frame input means 808 inputs the non-compression image into the P frame coding means 803 and I frame coding means 805 for each 1 frame. The P frame coding means conducts the P frame coding through the movement compensation, DCT conversion, quantization, and variable length coding processing, and outputs the coded frame to the compression frame data combination means 809, and outputs the bit amount of the coded frame to the bit amount buffer 804. The bit amount buffer 804 outputs the inputted bit amount to the I frame coding means 805.

[0114]

Then, the I frame coding means 805 conducts the I frame coding through the DCT conversion, quantization, and variable length coding processing, on the frame inputted from the input means 802, and outputs the coded frame to the compression frame data combination

means 809. Herein, the detailed structure of the I frame coding means 805 is shown in Fig. 37. In Fig. 37, the I frame coding means is connected to an input means 3701, and is structured by a DCT conversion means 3702, DCT coefficient memory 3703, quantization means 3704, variable length coding means 3705, and quantization value determination means 3706, and is connected to an output means 3707. In Fig. 37, the input means 3701 corresponds to the output of the frame input means 808 in Fig. 8, and the output of the bit amount buffer 804, and inputs the non-compression frame into the DCT conversion means 3702, and inputs the bit amount into the quantization value determination means 3706. The DCT conversion means 3702 DCT-converts the inputted non-compression data, and outputs it a DCT coefficient memory 3703. The DCT coefficient memory 3703 stores the inputted DCT coefficient in the internal memory, and inputs the DCT coefficient into a quantization means 3704. Further, when the DCT coefficient signal is inputted from the quantization value determination means 3706, the DCT coefficient stored in the internal memory is outputted to the quantization means 3704. The quantization means 3704 conducts the quantization by using the DCT coefficient inputted from the quantizatio coefficient memory, and the quantization value inputted from the quantization value determination means, and outputs it to the variable length coding means 3705. The variable length coding means 3705 conducts the variable length coding on the inputted data, and outputs the variable length coding data and its bit amount to the output means 3707, and the outputs the bit amount to the quantization value determination means 3706.

[0115]

The quantization value determination means 3706 stores the bit amount inputted from the input means 3701 in the internal memory, and outputs the previously determined quantization value to the quantization means 3704. Further, when the bit amount is inputted from the variable length coding means 3705, it is compared to the bit amount stored in the internal memory, and the next quantization value is determined so that the bit amount becomes small, and the quantization value is outputted to the quantization means 3704, and the DCT coefficient output signal is outputted to the DCT coefficient memory 3703. Further, by using the bit amount inputted from the variable length coding means 3705, the internal memory is renewed.

[0116]

After the above processings are repeated by the number of times of pieces of the rate correction data which is previously determined by the user, the quantization value determination means 3706 outputs the I frame coding end signal to the output means 3707.

[0117]

As described above, the I frame coding means 805 produces a plurality of I frames

whose bit amount is different from the inputted bit amount, and outputs the produced I frame and its bit amount to the compression frame data combination means. Finally, the compression frame data combination means 809 combines the P frame data inputted from the P frame coding means 803, and the rate correction data produced from a plurality of I frame data and their bit amounts inputted from the I frame coding means 805, in order, and outputs it to the output means 807. Fig. 27 is a view showing the rate correction data structure and the rate correction data header structure in the present sixth embodiment. Further, Fig. 28 is a view showing the data content of the rate correction data shown in Fig. 27. The rate correction data is, as shown in Fig. 27 and Fig. 28, structured by the rate correction data header and a plurality of I frames. The rate correction data header has the structure in which the number of I frames and respective bit amounts are accommodated in the fixed length.

[0118]

Next, the structure of the moving image coding apparatus in which the moving image data coded by the moving image data producing apparatus 801 is an input, and the rate control is conducted without coding, and the moving image data is newly produced, is shown in Fig. 9. The moving image coding apparatus 901 has the structure which is provided with a rate correction data extraction means connected to an input means 902 and a bit rate control means 905 connected to the input means 902 and the rate correction data extraction means, and further, a rate correction means 906 connected to a bit rate control means 905, and the rate correction data extraction means 903, and is connected to an output means 907.

[0119]

The operation of the moving image coding apparatus structured as described above, will be described below. The input means 902 inputs the moving image data coded by the moving image data producing means 801 for each 1 frame, into the rate correction data extraction means 903, and inputs the objective bit rate into the bit rate control means 905. The rate correction data extraction means 903 extracts the rate correction data from the inputted data and outputs it to the bit rate control means 905, and outputs the normal P frame data other than the rate correction data to the rate correction means 906, and outputs the bit amount of the P frame to the bit rate control means 905.

[0120]

Then, the bit rate control means 905 compares the objective bit rate inputted from the input means 902, to the bit amount inputted from the rate correction data extraction means 903, and when the bit rate is satisfied, and the frame which is preceding 1 frame is not frame-skipped, the control signal in which the rate correction is not necessary, is outputted to the rate correction means 906. In contrast to that, when the bit rate is not satisfied, or the

frame which is preceding 1 frame is frame-skipped, the rate correction data header is referred to, and from I frames in the rate correction data, the I frame which satisfies the objective bit rate is selected, and the selected I frame is outputted to the rate correction means 706. Further, even when the rate correction data is used, when the bit amount is excessive, the frame skip control signal is outputted to the rate correction means 906, and the information whether the frame skip control signal is emitted, is stored in the internal memory.

[0121]

Further, when the control signal of the rate correction unnecessary is inputted from the bit rate control means 905, the rate correction means 906 outputs the frame inputted from the rate correction data extraction means 903 as it is, to the output means 907, and when the I frame is inputted from the bit rate control means 905, the I frame is outputted to the output means 907, and when the frame skip control signal is inputted from the bit rate control means 905, the frame skip control signal is outputted to the output means 907. Finally, the output means 907 collects the frame data inputted from the rate correction means 906 for each 1 frame, and frame skip control signal, and the moving image data is produced. In this connection, when the frame skip control signal is inputted, the frame is skipped.

[0122]

In the present embodiment, because the input moving image data has the I frame as the rate correction data, even when the frame skip is conducted at the time of rate control, by using the I frame for the next frame, the generation of the movement compensation error can be prevented.

[0123]

Further, the number of pieces of the I frame which is the rate correction data, and the quantization value when the rate correction data is produced, can be set by the user corresponding to the range of the bit rate change. Foe example, when the quantization of the normal frame data is conducted at the quantization value Q = 2, and the bit rate is about 1.6 Mbps, the quantization is conducted by using 2 quantization values of Q = 6, Q = 29, as the rate correction data, and the data of about 384 kbps and about 64 kbps are produced. Then, by using together the rate correction data or frame skip, the moving image data in which the arbitrary bit rate change of range from about 1.6 Mbps to about 64 kbps is possible, can be produced.

[0124]

As described above, in the present embodiment, when the moving image data producing apparatus has a means for producing the I frame whose bit amount is different, as the rate correction data, and the moving image coding apparatus is provided with, as the rate

correction data, a means for selecting the I frame and conducting the rate control, the rate control can be quickly conducted without decoding the input moving image data, and further, the generation of the movement compensation error when the frame-skip is conducted, can be prevented, and a plurality of moving image data whose bit rates are different can be quickly produced, and its practical effect is large.

[0125]

(Embodiment 7)

In the seventh embodiment, in an apparatus by which the rate control is conduced from the previously coded moving image data without decoding the data, and the moving image data is newly produced, a moving image coding apparatus characterized in that a portion of the area in the frame of the moving image data is quarried out, and the frame size is different from the input moving image data, and the moving image data whose size is the quarried out frame size, is produced, will be described below. When the size is quarried out from the frame size of the input image data and the moving image data is produced, because the bit rate is not uniform, the bit is not regulated depending on the quarried out portion, and in order to quarry out, it is necessary that the bit rate is changed.

[0126]

Initially, the moving image data producing apparatus by which the moving image data which is an input of the moving image coding apparatus is produced, will be described, and next, the moving image coding apparatus by which the rate control is conducted from the previously coded moving image data without decoding the data, and the moving image data is newly produced, will be described below.

[0127]

In Fig. 29, the structure of the moving image data producing apparatus to produce the input moving image data of the moving image coding apparatus is shown. In Fig. 29, a moving image data producing apparatus 2901 is provided with: a frame input means 117 connected to an input means 116; movement compensation means 2902; DCT conversion means 103; quantization means 104; variable length coding means 105; inverse quantization means 106 to conduct the decoding; inverse DCT conversion means 107; and frame memory 108 to store the decoded frame, and is provided with: a maximum bit amount area detecting means 2910 to detect the area having the maximum bit amount, connected to the variable length coding means 105; reference inhibition area memory means 109; compression frame buffer 112 connected to the DCT conversion means 103; quantization means 2911 to conduct the quantization, connected to the compression frame buffer 112; and variable length coding means 2913, and is provided with: a compression frame data combination means 2914 to combine the

moving image data, connected to the variable length coding means 105, reference inhibition area memory means 109, and variable length coding means 2913, and has the structure connected to the output means 115. The operation of the moving image data producing apparatus structured as described above will be described below. In Fig. 29, operations of the movement compensation means 2902, maximum bit amount area detecting means 2910, quantization means 2911, variable length coding means 2913, and the operation of the blocks other than compression frame data combination means 2914 are entirely the same as in the Embodiment 1.

[0128]

An example of the quarry out area is shown in Fig. 30. In Fig. 30, 1 frame is divided into 4 quarry out areas surrounded by a bold line. The moving image data produced by the moving image data producing means in the present embodiment is different form the input frame size, and has the structure in which, for example, the moving image data can be produced by the moving image coding apparatus, which will be described later, as the frame size of an arbitrary quarry out area shown in Fig. 30.

[0129]

In the Embodiment 1, the maximum bit amount area detecting means 110 selects a plurality of areas in the order from the range including the maximum bit amount in the plurality of areas in 1 frame shown in Fig. 10, and to the selected area, by changing the quantization value by the quantization means 111, the rate correction data whose bit amount is different is produced.

[0130]

In contrast to that, in the present embodiment, the maximum bit amount area detecting means 2910 selects , for example, as shown in Fig. 30, to 1 frame which is divided into a plurality of quarry out areas (rectangular area shown by a bold line), a plurality of areas in the order from the area in which the bit amount is maximum in each quarry out area, and outputs the selected each area to the reference inhibition area memory means 109, and the compression frame buffer 112. In this connection, the quarried out area shown in Fig. 30 is an example, and the quarry out area can be arbitrarily determined. Further, the movement compensation means 2902 conducts the movement compensation by inhibiting the movement forecast to the reference inhibition area shown in the rate correction data 31 inputted from the reference inhibition area memory means and the quarry out area of the position which is different from the currently coded quarry area. For example, when the movement compensation is conducted on the quarry out area 1, the movement forecast is conducted only from the area excepting for the reference inhibition area in the quarry out area 1, in one preceding frame to the frame into

which the input is conducted from the frame memory 108. Tentatively, when the movement forecast is conducted to the outside of the quarry area, because there is no reference image to be used for the movement compensation when the area is quarried from the inside of one frame and the moving image data is produced, the decoding can not be conducted. As described above, by providing the limitation for the movement forecast, the decoding of the coded moving image data can be conducted by using not only the whole frame, but also only each quarry area, and the moving image data can be structured by quarrying out a portion from the frame of the coded moving image data.

[0131]

The quantization means 2911 changes the quantization value and conducts the quantization by using the DCT coefficient and quantization value of each area selected by the reference inhibition area shown in the rate correction area data inputted from the compression frame buffer 112, that is, selected by the maximum bit amount area detecting means 2910, and produces the data whose bit amount is different, and respectively outputs to the variable length coding means 2913.

[0132]

The variable length coding means 2913 conducts the variable length coding on the DCT coefficient whose bit amount is different, of each reference inhibition area inputted by the quantization means 2911, and produces the rate correction data having respective data sizes and area numbers as the header information, and outputs it to the compression frame data combination means 114. Herein, the data produced by the variable length coding means 2913 is called the rate correction data. In Fig. 33, the structure of the rate correction data is shown. In Fig. 33, the rate correction data header 3302, as shown in Fig. 34, has the structure in which the number of the correction data in each area, the area number in the frame, and the bit amounts of respective correction data, are accommodated as the fixed length data. Then, the rate correction data has the structure in which the correction data is accommodated in order succeeding to the rate correction data header 3302.

[0133]

The compression frame data combination means 2914 links in order the normal frame data inputted by the variable length coding means 105, the rate correction area data inputted by the reference inhibition area memory means 109, and the rate correction data inputted by the variable length coding means 2913 as shown in Fig. 32, and produces the compression frame data, and outputs it to the output means 115.

[0134]

Next, in Fig. 35, the structure of the moving image coding apparatus by which a

portion in the frame is quarried from the moving image data coded by the moving image coding apparatus in Fig. 29 without being coded, and the bit rate adjustment following the quarrying out is conducted, and the moving image data is newly produced, is shown.

[0135]

In Fig. 35, the moving image coding apparatus 3501 has the structure which is provided with: a data separation means 3507 connected to an input means 3502; bit amount calculation means 2303; rate correction data selection means 2404; thee bit rate control means 205; and moving image data combination means 208, and which is connected to the output means 206. The operation of the moving image coding apparatus structure as described above will be described below. In Fig. 35, the operations of blocks other than the input means 3502 and data separation means 3507, are entirely the same as in Embodiment 1.

[0136]

The input means 3502 inputs the moving image data which is compression coded by the moving image data producing means 2901, objective bit rate, quarry area information showing the quarry out method of 1 frame as shown in Fig. 30, and quarry out area number showing which portion of the input data is to be quarried out, to the data separation means 207. When the data is inputted into the data separation means 3507 by the input means 3502, the objective bit rate is inputted into the bit rate control means 205 for each 1 frame, and the data is taken out in order from the leading end of the inputted moving image data, the quarrying out and composition is conducted on the normal frame data corresponding to the quarry out area number, and it is inputted into the bit amount calculation means 203 for each 1 frame, and the rate correction data corresponding to the rate correction area data and the quarry out area number is inputted into the rate correction data selection means 204.

[0137]

Generally, in the case where, to the previously coded image data, a portion of the frame is quarried out and the new moving image data whose frame size is different, is produced, when the movement forecast is conducted from the area other than the area in which the previously coded image data is quarried out, the problem in which it can not be decoded, is generated. That is for the reason why the necessary reference data to decode the quarried out area does not exist inside the quarried out area. That is, because the necessary reference data exists outside the quarried out area, it is impossible that the quarrying out is simply conducted, and in order to quarry out a portion of the frame and produce the new moving image data whose frame size is different, it is necessary that, after whole frame is decoded once, the inside of the quarry out area is coded again, and there is a problem that the processing load is large.

[0138]

In contrast to that, in the present embodiment, when the data separation means 3507 quarries out the data of the area shown by the quarry out area number from the normal frame data, and composes the new frame whose frame size is different, because the movement forecast of the quarried area is conducted only in the same area, there is no case that the movement compensation error is generated by the quarrying out, and it can not be decoded. Accordingly, it can be quarried out and composed without decoding the data. Further, also the change of bit rate following the quarrying out, can be conducted without decoding the data by selecting the rate correction data by adjusting to the objective bit rate in the same manner as in Example 1.

[0139]

Further, the number of areas having the rate correction data and the rate correction data of each area can be set by the user corresponding to the range of the bit rate change, and has the same effect as in Embodiment 1, however, the rate correction data necessary only for conducting the bit rate adjustment following the quarrying out may be small. For example, when the quarry out areas are 4 and the quantization value of the normal frame data Q = 8, and the bit rate is about 256 kbps, as the rate correction data, at least one area in which the bit amount is large is selected in respective quarry out areas, and when the rate correction data of about 96 kbps (as the whole frame) in which the quantization is conducted by using the quantization value Q = 20, is produced, it is sufficiently enough for adjustment of the bit rate generated following the quarry out. That is, when the quarry out areas is 4, and the bit rate is about 256 kbps, it is necessary that the bit rate of the frame quarried out by the quarry out of the area is 1/4 of the whole, that is, about 64 kbps, however, in practice, by the deviation of the bit amount, the area over 64 kbps exists. In the present embodiment, the rate correction data is produced, and by using the rate correction data at the time of quarry out of the area, the bit rate of such the area can be adjusted.

[0140]

As described above, in the present embodiment, the moving image data structure having the area having the rate correction data in which the bit amount is different for each quarry area, a means by which the area of a portion in the frame is quarried out and composed, and an area selection means for selecting the rate correction data corresponding to the bit rate, are provided, thereby, a portion of the frame is quickly quarried out without decoding the moving image data, and without generating the deterioration of image quality, and further, the bit rate adjustment can be conducted and the new moving image data whose frame size is different, can be produced, and its practical effect is large.

[0141]

Further, in the present embodiment, when a point that the area having the reference

inhibition area and rate correction data is produced in 1 frame, is changed to that it is produced for each quarry out area, and following that, also for the movement compensation, the movement forecast is not conducted from the outside of the quarry out area, it is shown that the effect in which, not only by conducting the rate control without decoding the coded moving image data, but also by quarrying out a portion in the frame without decoding the data, the moving image data whose frame size is different can be produced, can be obtained, and for Embodiment 2 to Embodiment 6, by conducting the same change, a portion in the frame is quarried out, and the moving image data can be produced.

[0142]

Further, in Embodiments 1 to 7, it is described that the moving image data producing apparatus accommodates the rate correction data after the normal frame date, however, the position to be accommodated, is not limited to this. For example, when the moving image data producing apparatus accommodates the rate correction data after the user data start sign in the moving image data, the data can be reproduced by using the normal moving image decoding apparatus.

[0143]

Herein, the user data start sign is, for example, as shown in ISO/IEC 11172-2 which is the standard book of MPEG coding, a sign showing the start of the area which is prepared for the future expansion, and the normal moving image decoding apparatus skips over the data from the user data start sign to the next start sign and conducts the decoding. Accordingly, the moving image data produced by the moving image data producing apparatus in Embodiments 1 to 7, can be reproduced by using the normal moving image decoding apparatus.

[0144]

Further, in the present invention, the input data of the moving image coding apparatus and output data are compared with each other, or a plurality of output data whose bit rates are different, are compared, and when bit arrangement is locally different, it is structured in such a manner that the bit arrangement is accommodated in the user data, or a position other than the normal frame data.

[0145]

Further, when the monochrome frame is an input, each frame of the moving image data outputted by the moving image data producing apparatus has the periodic structure in which, other than normal frame data, as the rate correction data, the entirely same data are periodically included by the number of areas between the areas, and because the entirely the same rate correction data is also included between the frames, the moving image data has the periodic structure.

[0146]

[Effect of the Invention]

As described above, firstly, when the moving image data has the structure having the rate correction data whose bit amount is different, to the area in which the bit amount in the P frame (forecast coding image between frames) is large, in the case where the moving image data is newly produced from the previously coded moving image data, by selecting the data whose bit amount is different, corresponding to the objective bit rate, the bit rate can be changed without decoding the moving image data, and the moving image data can be quickly produced.

[0147]

Secondly, in the case where the moving image data has the rate correction data in which the bit amount is different, and the rate change can be conducted, on the predetermined area in which the probability referred to at the time of the movement forecast from the next frame is low in the P frame (forecast coding image between frames), and the moving image data is newly produced from the previously coded moving image data, by selecting one data from rate correction data whose bit amount is different, in the input moving image data, corresponding to the objective bit rate, the bit rate can be changed without decoding the moving image data, and the moving image data can be quickly produced. Further, by producing the rate correction data in the area in which the probability referred to from the next frame is low, the lowering of the forecast coding efficiency due to the influence of the search area limitation of the movement forecast, can be reduced.

[0148]

Thirdly, in the moving image data producing apparatus, by providing the movement compensation means for inhibiting the reference, at the time of the movement forecast of the next frame, to the area having the rate correction data in the P frame of the moving image data to conduct the coding, when the moving image data is newly produced from the coded moving image data, even by selecting the rate correction data whose bit amount is different, corresponding to the objective bit rate, the generation of the movement compensation error due to the change of the data can be prevented.

[0149]

Fourthly, in the moving image data producing apparatus, when the P frame of the moving image data is produced, to the area in which the referred degree data showing the area in the preceding frame used for reference at the time of movement forecast is recorded, and by using the referred area data, which is selected as the area that the referred degree is low, by providing the means for producing the rate correction data whose bit amount is different, the moving image coding can be conducted without lowering the coding efficiency of the forecast

coding between frames. Further, when the moving image data is newly produced from the previously coded moving image data, by selecting the data whose bit amount is different, corresponding to the objective bit rate, the bit rate can be quickly changed without decoding the data, and the moving image data can be produced.

[0150]

Fifthly, in the moving image data producing apparatus, by providing the means for producing the data in which the forecast coding between frames is conducted on the original image to the P frame of the moving image data, and the means by which the high frequency component of the original image is removed, and by conducting the forecast coding between frames, the rate correction data whose bit amount is different, is produced, when the moving image data is newly produced without decoding the coded moving image data, by selecting a plurality of areas in the rate correction data, in which the high frequency component is removed and coded, and bit amounts are different, the fine bit rate control can be quickly conducted.

[0151]

Sixthly, in the moving image data producing apparatus, by providing the means for producing the position at which the subsequent bit can be deleted, and the termination data to each Video Packet of the moving image data, in the moving image coding apparatus by which the new moving image data is produced from the coded moving image data is produced, by selecting the Video Packet corresponding to the objective bit rate, and by deleting the rear portion bits, the bit rate control can be quickly conducted.

[0152]

Seventhly, in the moving image data producing apparatus, in the case where the means for producing a plurality of I frames whose bit amounts are different, as the rate correction data, to the P frame of the moving image data, is provided, when the moving image data is newly produced from the previously coded moving image data, by selecting or frame skipping the rate correction data corresponding to the objective bit rate, the bit rate control can be quickly conducted, and the moving image data can be produced.

[0153]

Eighthly, in the case where the structure in which an area having together the rate correction data whose bit amount is different in the P frame (forecast coding image between frames) of the moving image data is provided at least one for each quarry out area determined in the frame is provided, and the moving image data producing means is provided with the movement compensation means in which the movement forecast is not conducted from the different quarry out area and the area having the rate correction data, when one portion in the frame is quarried out from the previously coded moving image data and the moving image data

is newly produced, by selecting the data whose bit amount is different, corresponding to the objective bit rate, the bit rate can be controlled without decoding the moving image data, and without generating the movement compensation error, and the moving image data can be quickly produced.

[Brief Description of the Drawings]

Fig. 1 is a block diagram showing the structure of a moving image data producing apparatus in the first embodiment of the present invention.

Fig. 2 is a block diagram showing the structure of a moving image coding apparatus in the first embodiment of the present invention.

Fig. 3 is a block diagram showing the structure of the moving image data producing apparatus in the second embodiment of the present invention.

Fig. 4 is a block diagram showing the structure of the moving image data producing apparatus in the third embodiment of the present invention.

Fig. 5 is a block diagram showing the structure of the moving image data producing apparatus in the fourth embodiment of the present invention.

Fig. 6 is a block diagram showing the structure of the moving image data producing apparatus in the fifth embodiment of the present invention.

Fig. 7 is a block diagram showing the structure of the moving image coding apparatus in the fifth embodiment of the present invention.

Fig. 8 is a block diagram showing the structure of the moving image data producing apparatus in the sixth embodiment of the present invention.

Fig. 9 is a block diagram showing the structure of the moving image coding apparatus in the sixth embodiment of the present invention.

Fig. 10 is a view showing an example of an area dividing the inside of the frame in the first embodiment of the present invention.

Fig. 11 is a view showing a compression frame buffer structure in the first embodiment of the present invention.

Fig. 12 is a view showing the rate correction area data in the first embodiment of the present invention.

Fig. 13 is a view showing the compression frame data in the first embodiment of the present invention.

Fig. 14 is a view showing the moving image data structure in the first embodiment of the present invention.

Fig. 15 is a view showing the data structure of the rate correction data in the first embodiment of the present invention.

Fig. 16 is a view showing the content of the rate correction data in the first embodiment of the present invention.

Fig. 17 is a view showing the rate correction data header structure in the first embodiment of the present invention.

Fig. 18 is a view showing the referred area data in the third embodiment of the present invention.

Fig. 19 is a view showing the compression frame data in the fourth embodiment of the present invention.

Fig. 20 is a view showing the rate correction data header structure in the fourth embodiment of the present invention.

Fig. 21 is a view showing the structure of the moving image coding apparatus in the fourth embodiment of the present invention.

Fig. 22 is a view showing a flow of a rate control method in the fourth embodiment of the present invention.

Fig. 23 is a view showing the structure of a Video Packet in the fifth embodiment of the present invention.

Fig. 24 is a view showing the Video Packet termination data structure in the fifth embodiment of the present invention.

Fig. 25 is a view showing the rate correction data structure and the rate correction data header structure in the fifth embodiment of the present invention.

Fig. 26 is a view showing the data content of the rate correction data in the fifth embodiment of the present invention.

Fig. 27 is a view showing the rate correction data structure and the rate correction data header structure in the sixth embodiment of the present invention.

Fig. 28 is a view showing the data content of the rate correction data in the sixth embodiment of the present invention.

Fig. 29 is a view showing the structure of the moving image data producing apparatus in the seventh embodiment of the present invention.

Fig. 30 is a view showing an example of a quarry out area in the 1 frame in the seventh embodiment of the present invention.

Fig. 31 is a view showing the rate correction area data structure in the seventh embodiment of the present invention.

Fig. 32 is a view showing the compression frame data structure in the seventh embodiment of the present invention.

Fig. 33 is a view showing the rate correction data structure in the seventh embodiment

of the present invention.

Fig. 34 is a view the rate correction data header structure in the seventh embodiment of the present invention.

Fig. 35 is a view showing the structure of the moving image coding apparatus in the seventh embodiment of the present invention.

Fig. 36 is a view showing the Video Packet structure data in the fifth embodiment of the present invention.

Fig. 37 is a view showing the structure of I frame coding means in the sixth embodiment of the present invention.

Fig. 38 is a block diagram showing the structure of the moving image coding apparatus which is the conventional technology.

[Description of the Reference Numerals and Signs]

101: Moving image coding apparatus
102: Movement compensation means
103: DCT conversion means
104: Quantization means
105: Variable length coding means
106: Inverse quantization means
107: Inverse DCT conversion means
108: Frame memory
109: Movement compensation means
110: Maximum but amount detecting means
111: Quantization means
112: Compression frame buffer
113: Variable length coding means
114: Compression frame data combination means
115: Output means
116: Input means
117: Frame input means
201: Moving image data producing means
202: Input means
203: Bit amount calculation means
204: Rate correction data selection means
205: Bit rate control means

206: Output means
207: Data separation means
208: Moving image data combination means
301: Moving image data producing means
302: Movement compensation means
303: DCT conversion means
304: Quantization means
305: Variable length coding means
306: Inverse quantization means
307: Inverse DCT conversion means
308: Frame memory
309: Reference inhibition area memory means
310: Rate correction area selection means
311: Quantization means
312: DCT coefficient buffer
313: Variable length coding means
314: Moving data combination means
315: Output means
316: Input means
401: Moving image data producing means
402: Input means
403: Movement compensation means
404: DCT conversion means
405: Quantization means
406: Variable length coding means
407: Inverse quantization means
408: Inverse DCT conversion means
409: Frame memory
410: Referenced area memory means
412: Rate correction are selection means
413: DCT coefficient buffer
414: Quantization means
415: Variable length coding means
416: Variable length coding buffer
417: Moving data combination means

418: Output means

501: Moving image data producing apparatus

503: Low pass filter

504: Compression frame data combination means

601: Moving image data producing apparatus

602: Input means

603: Moving image data coding means

605: Data division position selection means

606: Rate correction data producing means

607: Rate correction information memory means

608: Moving image data combination means

609: Output means

701: Moving image coding apparatus

702: Input means

703: Rate correction information extraction means

704: Data composition means

705: Bit rate control means

706: rate correction means

707: Output means

801: Moving image data producing apparatus

802: Input means

803: Forecast coding between frames means

804: Bit amount buffer

805: In-frame coding means

806: Moving image data combination means

807: Output means

901: Moving image coding apparatus

902: Input means

903: Rate correction data extraction means

904: Data composition means

905: Bit rate control means

906: Rate correction means

907: Output means

1401: Moving image data

1501: Rate correction data

1502:	Rate correction data header
1701:	Referred area data
1801:	Compression frame data
1901:	rate correction data header
2101:	Moving image coding apparatus
2104:	rate correction data selection means
2301:	Video Packet
2401:	Video Packet termination data
2501:	Rate correction data
2502:	Rate correction data header
2801:	Rate correction data
2802:	Rate correction data header
2901:	Moving image data producing apparatus
2902:	Movement compensation means
2910:	Maximum bit amount area detecting means
2911:	Quantization means
2913:	Variable length coding means
2914:	Compression frame data combination means
3101:	Rate correction area data
3201:	Compression frame data
3301:	Rate correction data
3302:	Rate correction data header
3501:	Moving image coding apparatus
3502:	Input means
3507:	Data separation means apparatus
5002:	Variable length decoding means
5003:	Re-quantization means
5004:	Variable length coding means
5005:	Buffer memory means
5006:	Buffer occupation amount detecting means
5007:	Input means
5008:	Output means

[Designation of Document] Abstract

[Abstract]

[Problem]

When the bit rate of the moving image data is changed, and the moving image data is newly produced, to quickly realize the moving image data production without decoding the moving image data, and without generating the image quality deterioration due to the movement compensation error.

[Means for Resolution]

The non-compression moving image data is an input, quantization means, and rate correction data producing means for producing the rate correction data which is the data to be used at the time of bit rate change, are provided, and the moving image data having together the rate correction data other than the normal moving image stream is produced. Thereby, by selecting and replacing the rate correction data whose bit amount is different in the input moving image data, by adjusting to the objective bit rate, the bit rate is changed and the moving image data can be quickly produced without decoding the moving image data.

[Selected Drawing] Fig. 1